Baylor College of Medicine

TRANSLATIONAL RESEARCH INSTITUTE FOR SPACE HEALTH

TRISH: Bold Science for Space Health Challenges

Kristin Fabre, Ph.D.

Chief Scientist

Assistant Professor

Center for Space Medicine

Baylor College of Medicine

bcm.edu/spacehealth

WHAT IS TRISH?

The Translation Research Institute for Space Health (TRISH)

A **PARTNER** to NASA Human Research Program

Focused on translating disruptive approaches to reduce spaceflight hazards - we take risks, we challenge the boundaries

Funded through a **COOPERATIVE AGREEMENT** with NASA to Baylor College of Medicine

Baylor College of Medicine

Caltech

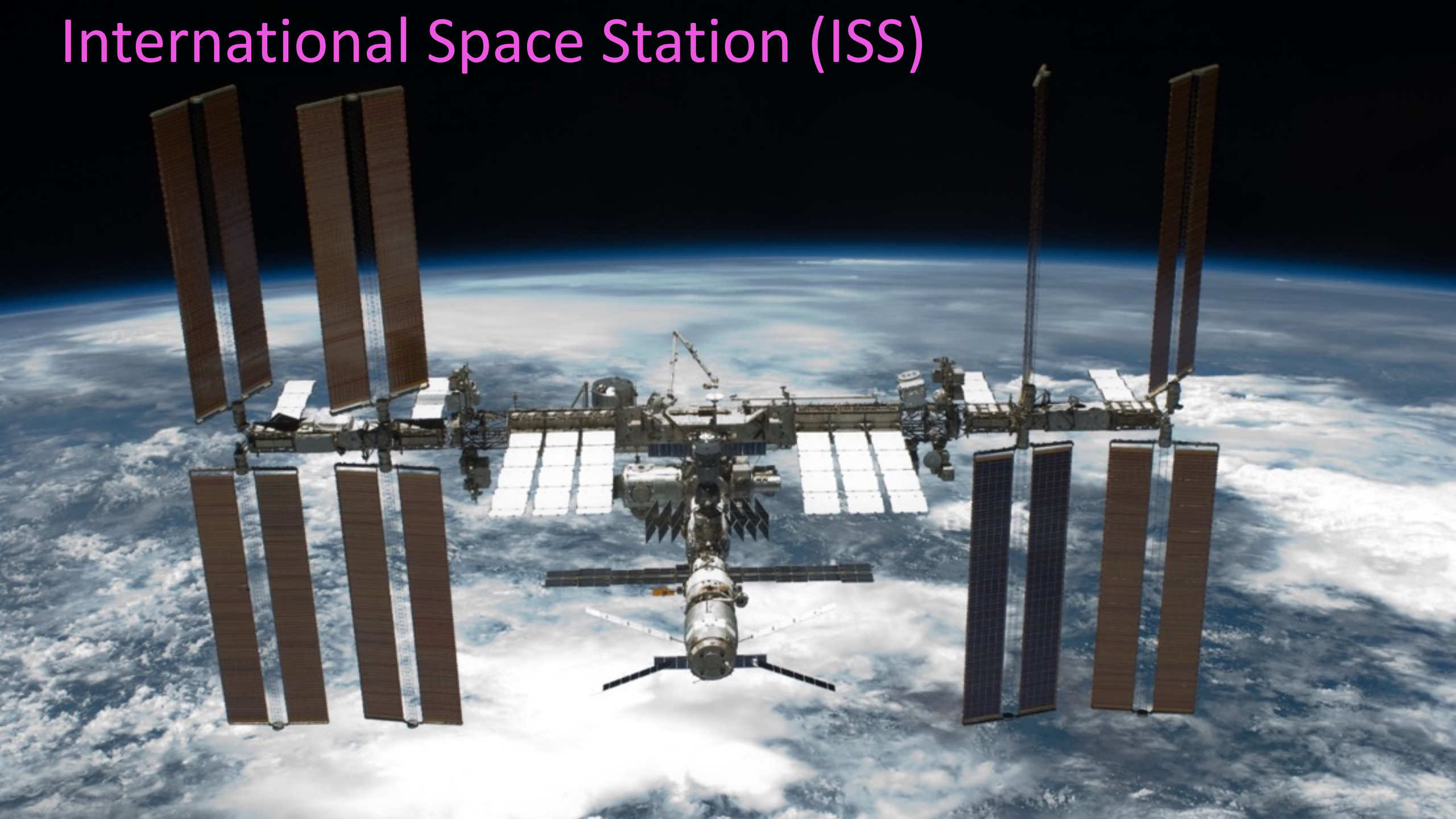
Massachusetts Institute of Technology

High-risk Research and Technology Development

Critical steps for our journey...

Image from weather.com

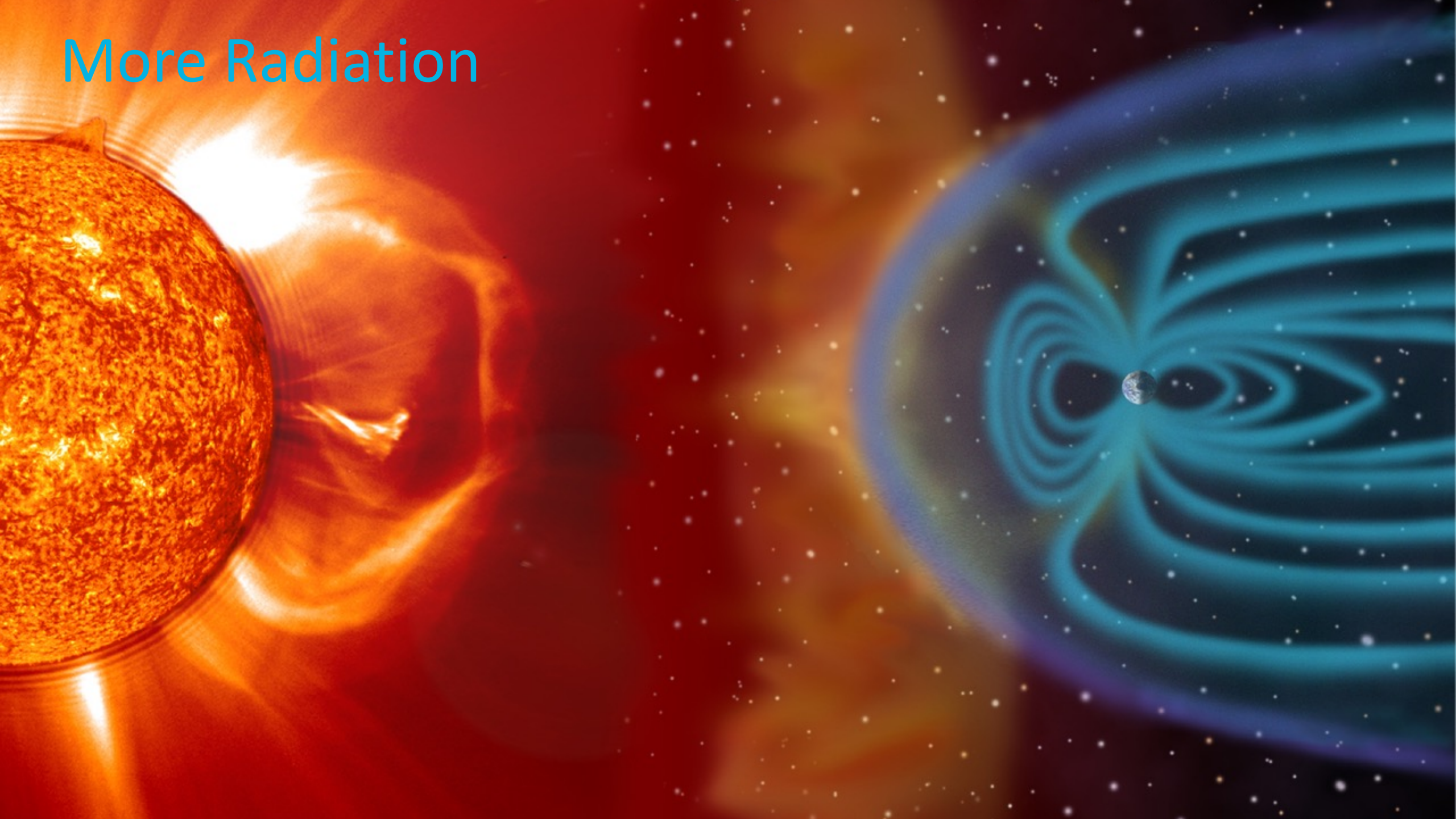
International Space Station (ISS)



Isolation & Confinement

Distance from Earth

More Radiation

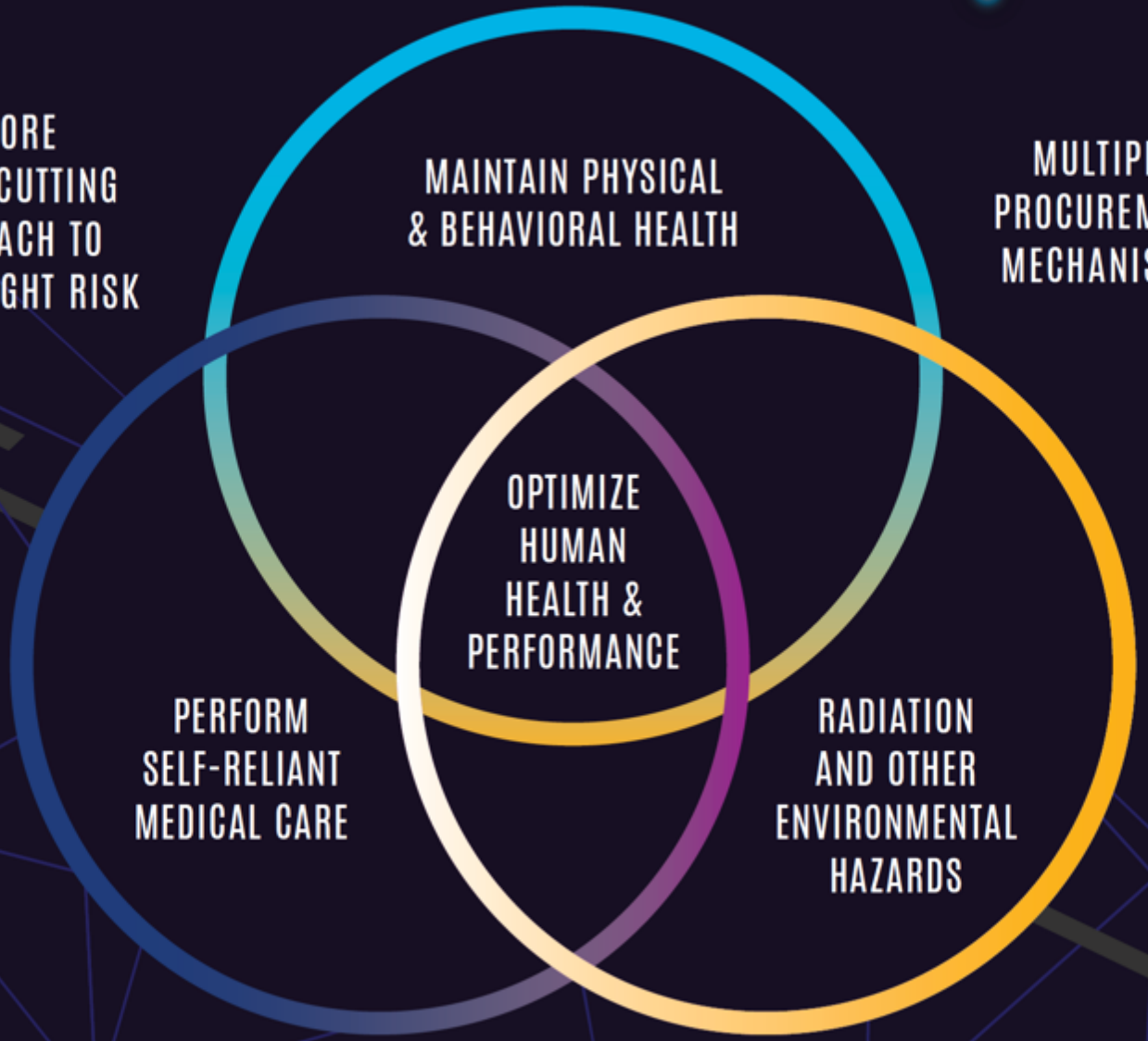


SCIENCE

HOW TRISH SEES IT

ADAPTING AND GROWING INTO A ROBUST INNOVATION INSTITUTE

A MORE CROSS-CUTTING APPROACH TO SPACEFLIGHT RISK



MULTIPLE PROCUREMENT MECHANISMS

BASED ON PRIORITY, DELIVERABLE, & COMPLEXITY

TRISH Areas of Investment on the Risk Spectrum

Disruptive

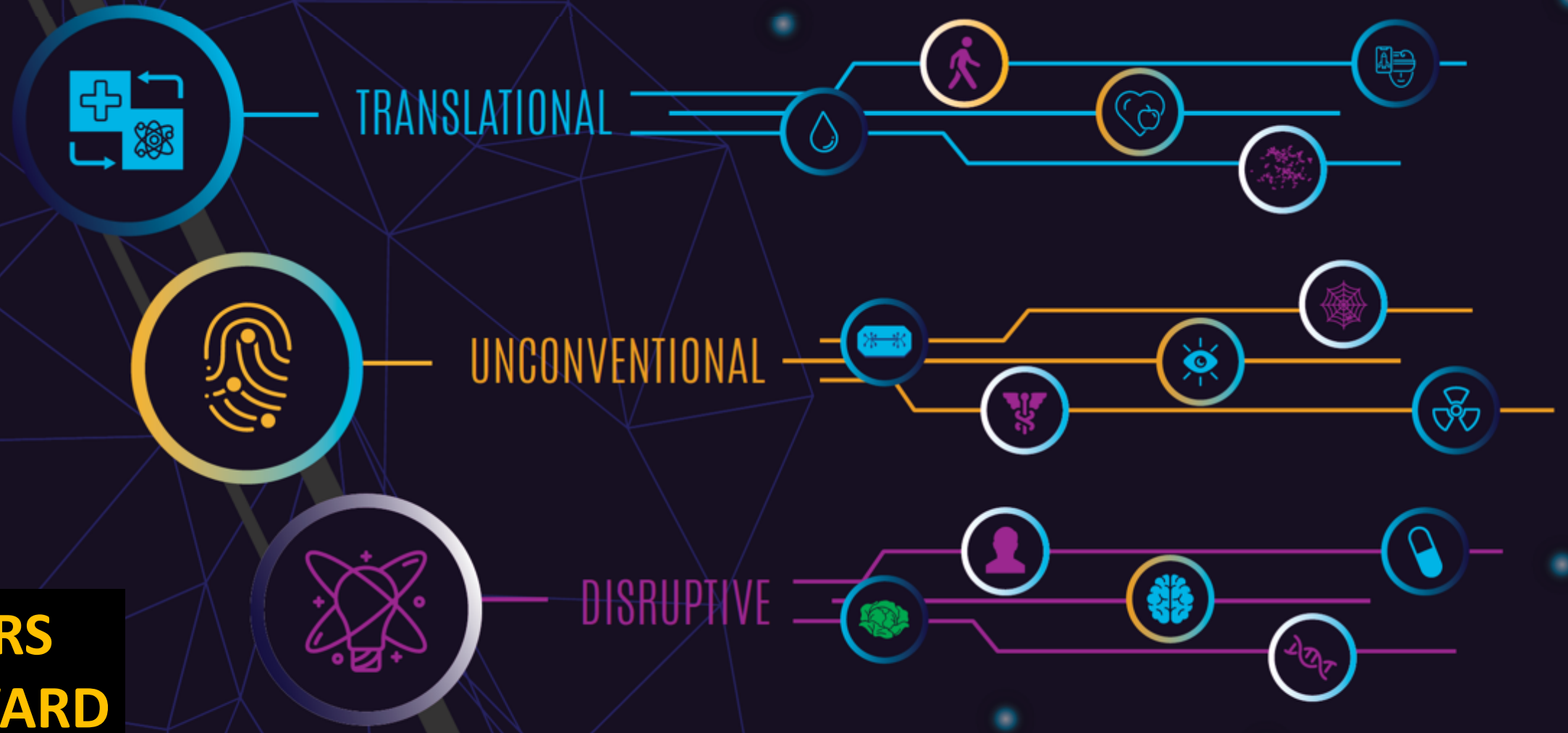
Translation

COUNTERMEASURE & TECHNOLOGY READINESS LEVEL

EXAMPLES OF TRISH-FUNDED RESEARCH

SCIENCE

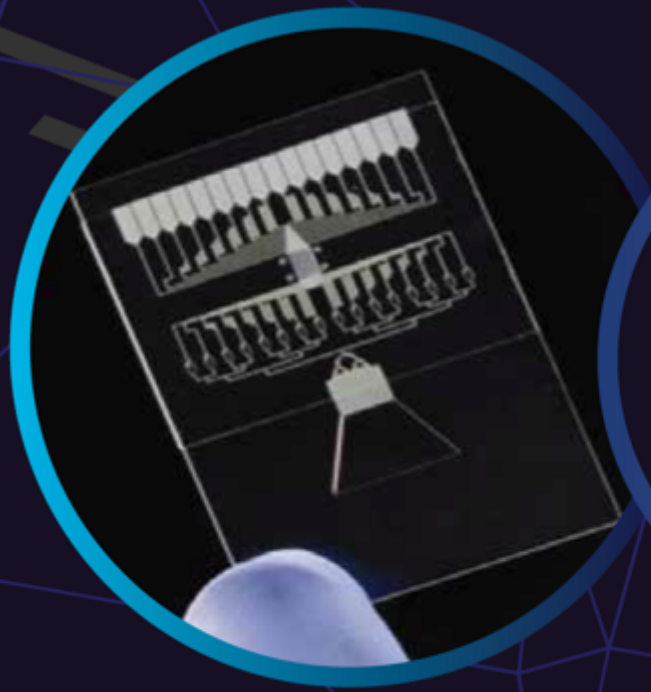
What Does TRISH Do?



MARS FORWARD

TRANSLATIONAL: BLOOD BASED ANALYTICAL TOOLS

LUC GERVAIS, PH.D./1DROP DIAGNOSTICS



MEASURE
64 BIO-MARKERS

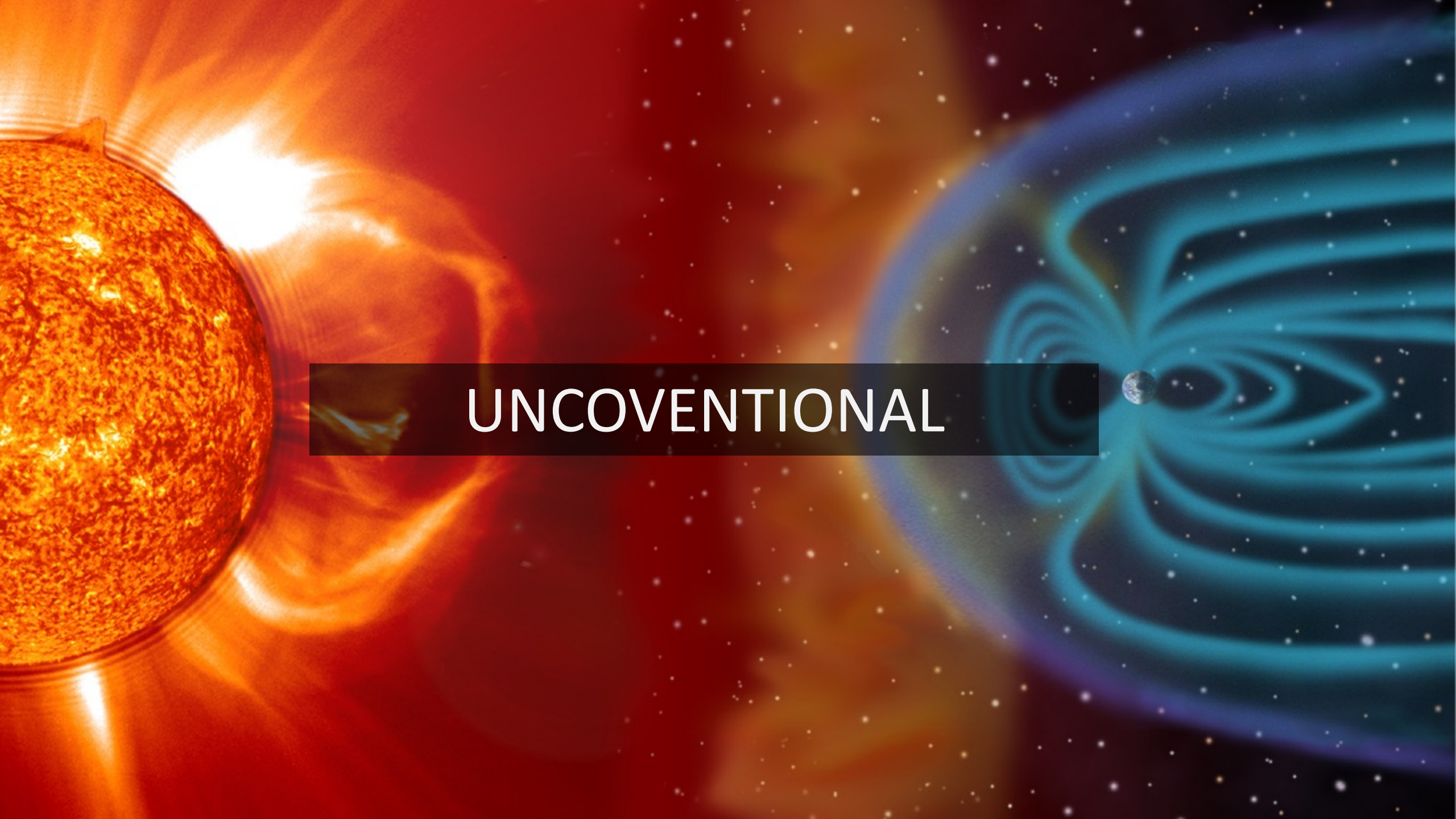
MICROFLUIDIC CARTRIDGE

MINIATURIZED, EASY-TO-USE DEVICE
SET TO BE TESTED ON ISS

DISRUPTIVE: PHARMACEUTICAL ON-DEMAND

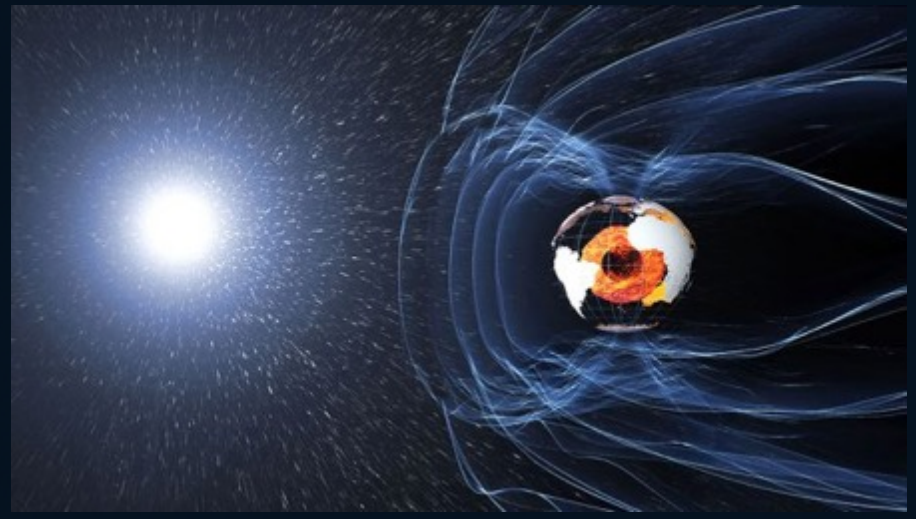
KAREN MCDONALD, PH.D./UC DAVIS

EHEALTH


UNCOVENTIONAL

Human Complex In Vitro Models for Radiation Countermeasures

- Galactic Cosmic Radiation (GCR) is a unique hazard associated with space exploration
- Consistent exposure in space, accumulates over the mission
- No known effective shielding against GCR



- A Primary risk for space exploration
- No ideal GCR models on Earth
- What type of damage could be done to human organs?
- How concerned should we be?

TRISH Space Radiation Solicitation (TSRAD 2020)

1. Determine if **complex human *in vitro* or *ex vivo* models could be an effective human analog** for radiation studies; and
2. **Test and characterize countermeasures** for efficacy against high LET ionizing radiation

How could we use human tissue models to understand GCR?

Determine if complex human *in vitro* models could be used as an analog for radiation response and countermeasure screening

TRAD has the following grant structure for the three years of proposed research:

- Year 1: characterizing platform for radiation research; up to $1M TOTAL
- Year 2: countermeasure development and characterization; up to $1M TOTAL
- Year 3: **COMPLETE COUNTERMEASURE** testing; up to $1.3M TOTAL
- 3 full-funded projects, $9.9M (TOTAL for 3 years)
- 2 partial-funded projects, $2M (TOTAL for 2 years, possible competitive 3rd year extension)

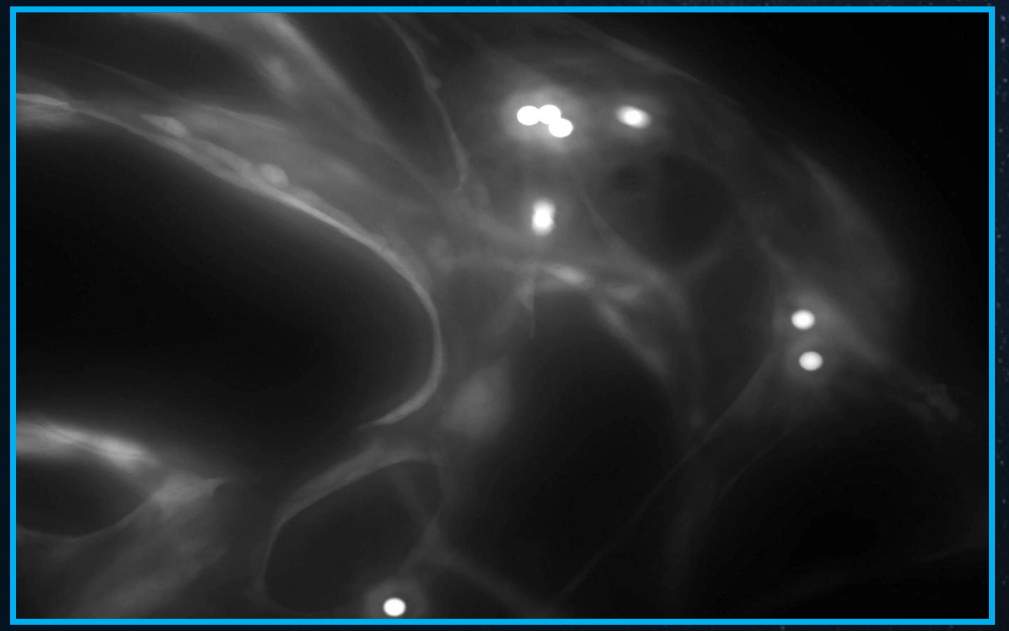
1. **Michael Weil, Ph.D.;** Colorado State University, Colorado
   Effects of chronic high LET radiation on the human heart....FULL FUNDING

2. **Gordana Vunjak-Novakovic, Ph.D;** Columbia University, New York
   Human multi-tissue platform to study effects of space radiation and countermeasures...FULL FUNDING

3. **Sharon Gerecht, Ph.D.;** Johns Hopkins University, Maryland
   Using human stem-cell derived vascular, neural and cardiac 3D tissues to determine countermeasures for radiation...FULL FUNDING

4. **Sarah Blutt, Ph.D.;** Baylor College of Medicine, Texas
   Use of Microbial Based Countermeasures to Mitigate Radiation Induced Intestinal Damage...PARTIAL FUNDING

5. **Mirjana Maletic-Savatic, M.D., Ph.D.;** Baylor College of Medicine, Texas
   Counteracting space radiation by targeting neurogenesis in a human brain organoid model...PARTIAL FUNDING



Wang X et al
Methods Mol Biol. 2017;1612:325-344. doi: 10.1007/978-1-4939-7021-6_24.

A NOVEL APPROACH TO RADIATION RESEARCH

How is this TRISH project different from HRP radiation efforts or other tissue chip research:

- First time that normal human cells/organoids will be exposed to simulated Mars-mission relevant space radiation
- Novel human, physiologically relevant models for radiation countermeasure testing
- iPSC = personalized capabilities
- TSRAD projects collectively represent several of the radiation sensitive organs and tissues of greatest concern for deep space
- The projects will be coordinated and managed out of TRISH HQ. All data generated will be standardized, tagged, and integrated into a data matrix model, will be used to build a sensitivity profile for each "astronaut avatar on a chip"

A Bold Vision for the TRISH “Space Health for All”: Chips on the Moon Could Help Us Understand Biological Hazards

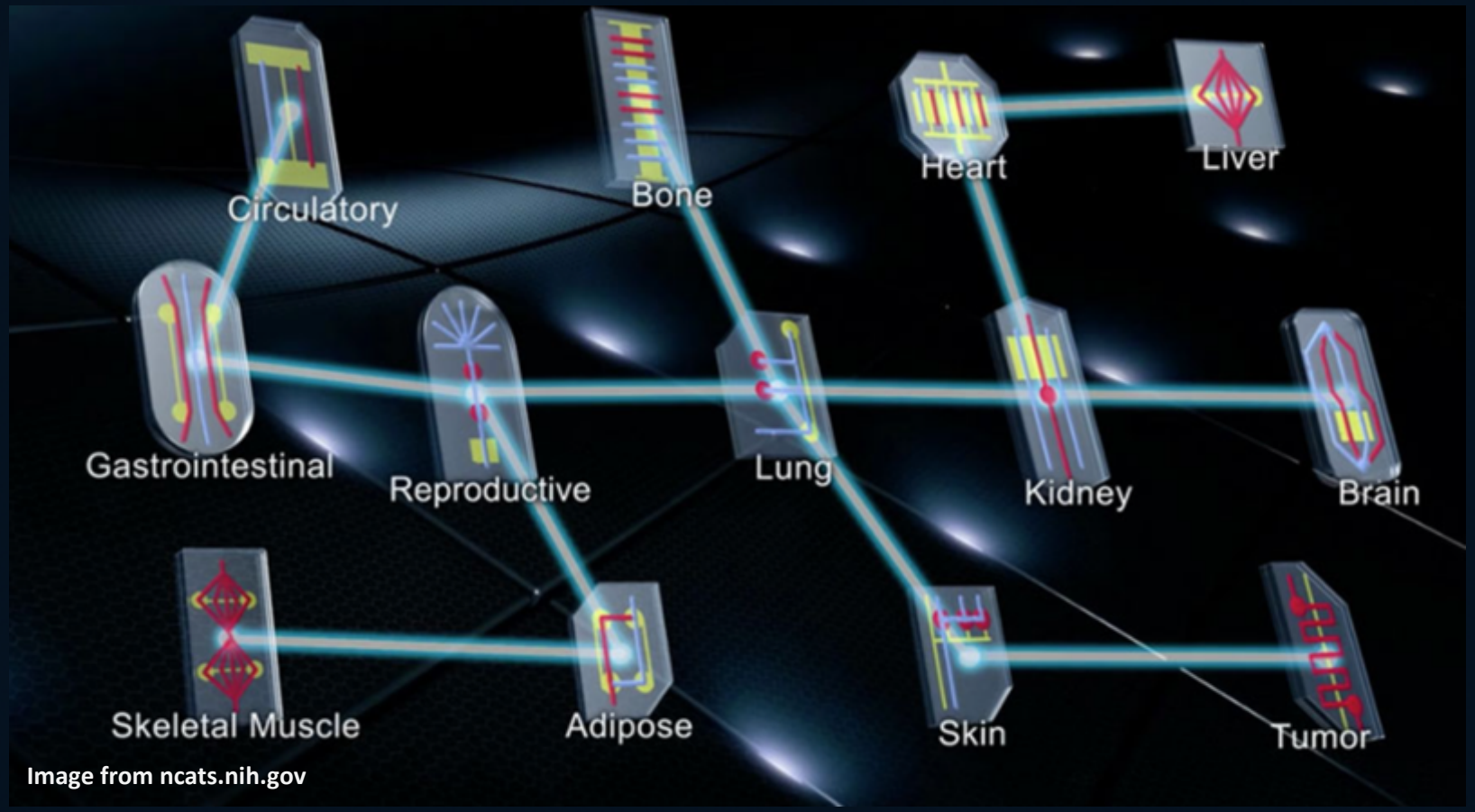


Image from ncats.nih.gov

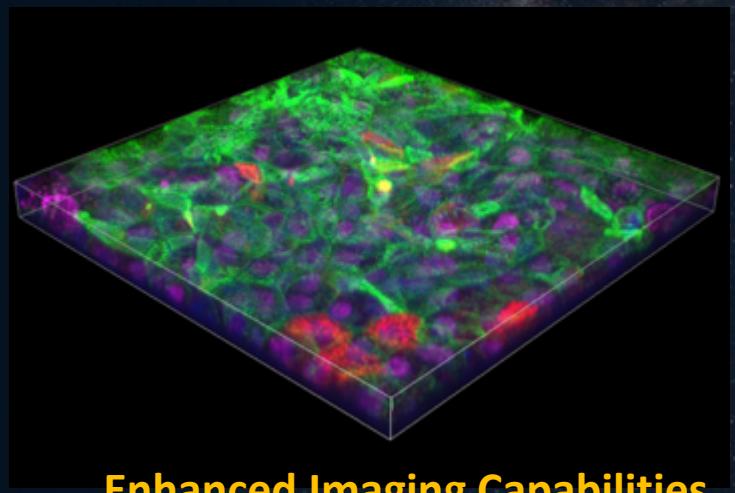
How will your tissues respond to a space environment? What would be the best interventions for you?

BCM.EDU/SPACEHEALTH

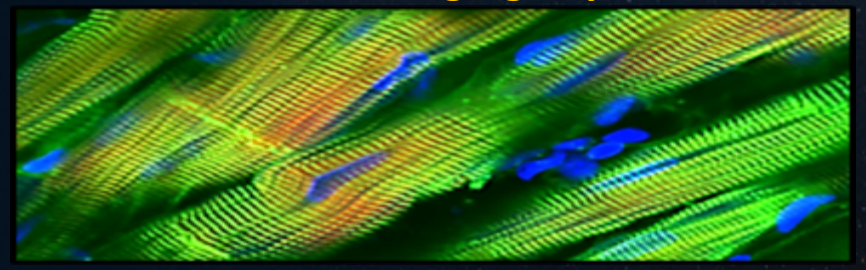
Technical Advances for Human Tissue Chips on the Moon will Also Provide Opportunities on Earth

Real-time Readouts

Image from L. Griffith MIT



Enhanced Imaging Capabilities



Long-term Living Tissues

Image from ncats.nih.gov

Complete Automation

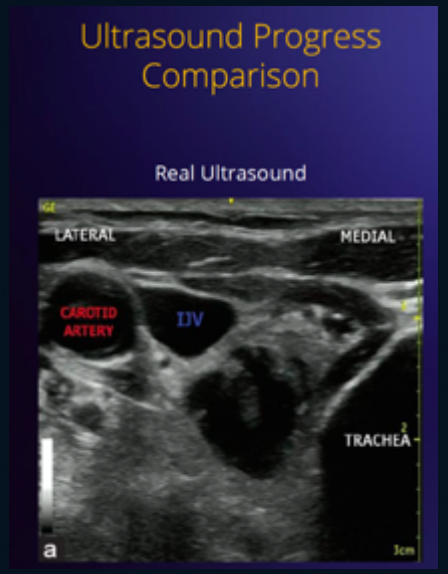
Image from Space Tango, bullhorncreative.com

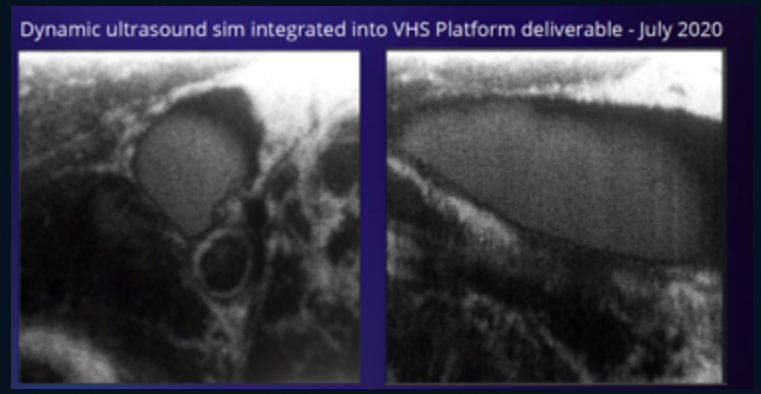
BCM.EDU/SPACEHEALTH

AND MORE ON PERSONALIZED RISK ASSESMENTS

Level Ex: A Digital Human Framework for Personalized Training and Simulation

Producing known medical scenarios on ISS, replicating microgravity conditions, clinical data-to-avatar personalization development pipeline





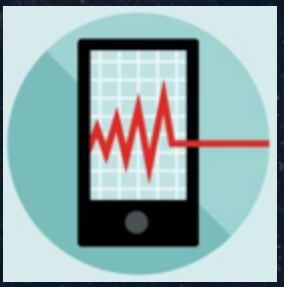
Advanced Ultrasound Simulation

Clinical data pipeline

- Imaging
- Genomic data
- Epigenetic data
- Biological cellular data

Personalized digital human avatar

- Digital Human Framework
- Multiscale Computational Model Output



Personalized clinical decision support and treatment

- Identified predispositions to spaceflight-associated conditions pre-travel
- Near real-time personalized prescriptive treatment recommendations

BCM.EDU/SPACEHEALTH

TRISH INDUSTRY

ENTREPRENEURIAL

ITERATIVE PROCESS:
INDUSTRY PROGRAM 20

OPPORTUNITY

CIMIT FOCUSING ON VERY EARLY STAGE COMPANIES

CIMIT REACHING OUT TO UNIVERSITY ENGINEERING DEPARTMENTS

CHANGE

BROUGHT IND 2020 IN HOUSE

INCREASED AWARDS UP TO $500K

EXTENSIVE OUTREACH INTO LAYERS OF HEALTH INNOVATION

OUTCOME

INCREASE APPLICANT POOL BY 45%

STRONGER POOL OF APPLICANTS

SCIENCE

IND 2020 AWARDEES

RACHNA DAHMIJA, PH.D.

Conversational Intelligent Agents
to analyze Astronaut
Behavioral Health and Performance

PHILIP STRANDWITZ, PH.D.

Development of Next-Generation
Probiotics derived from
the healthy human microbiome

JOSH RUBEN

Oculometric Cognition Testing and
Analysis in Virtual Environments
(OCTAVE)

ENTREPRENEURIAL

ITERATIVE PROCESS:

INDUSTRY PROGRAM 21 AND BEYOND

OPPORTUNITY

LITTLE GRANT EXPERIENCE

INCOMPLETE PROPOSALS

NOT WRITTEN FOR SPACE HEALTH

CHANGE

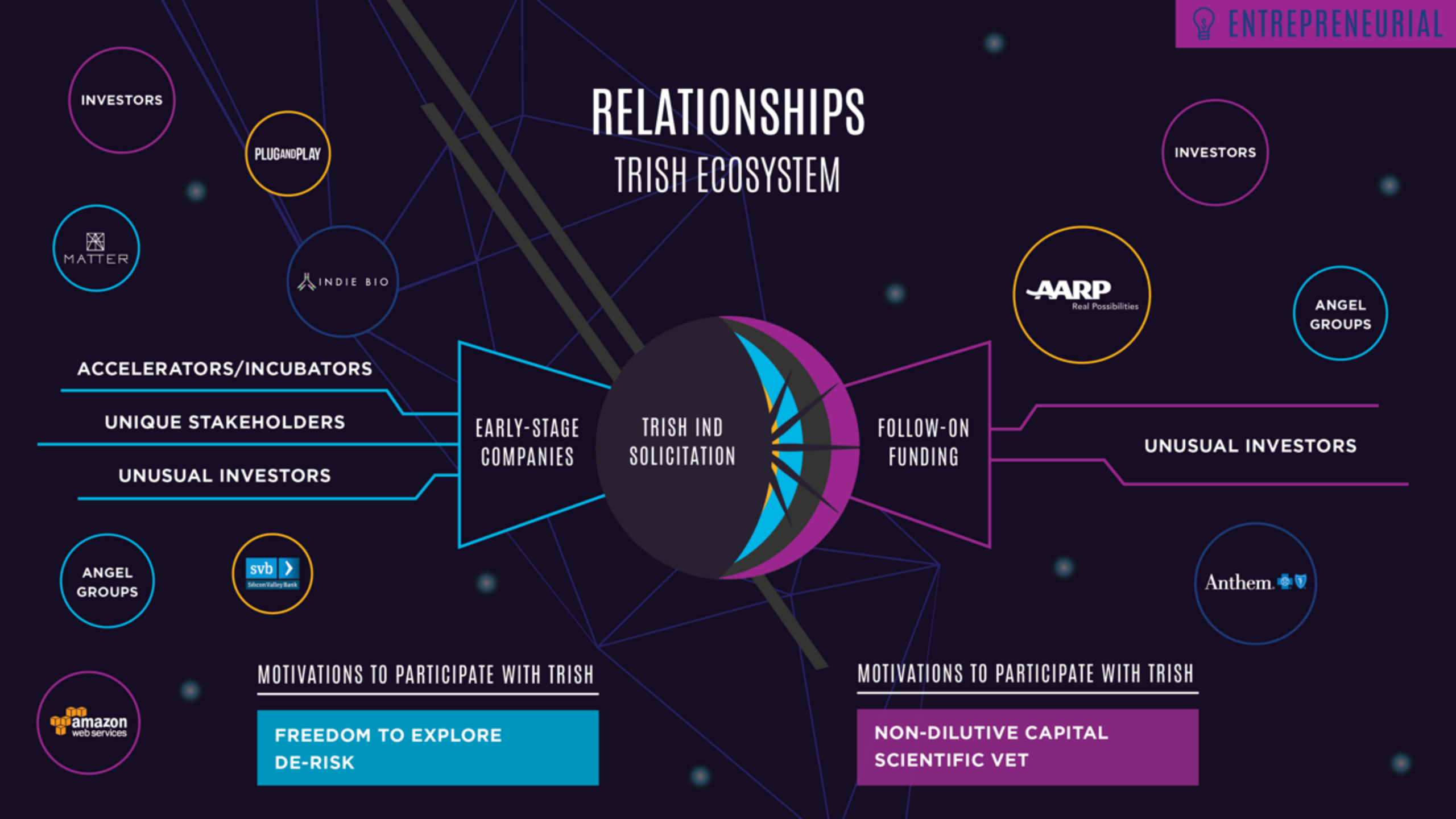
ROLLING SUBMISSION (NO CLOSE DATE)

INTERACTIVE PITCH INTAKE (THEIR LANGUAGE)

EDUCATE THEM FOR DEEP SPACE

OUTCOME

HYPOTHESIS:
HIGHER CALIBER PROJECTS FUNDED


ENTREPRENEURIAL
RELATIONSHIPS
TRISH ECOSYSTEM
INVESTORS
PLUGANDPLAY
MATTER
INDIE BIO
ACCELERATORS/INCUBATORS
UNIQUE STAKEHOLDERS
UNUSUAL INVESTORS
ANGEL GROUPS
svb
Silicon Valley Bank
amazon web services
EARLY-STAGE COMPANIES
TRISH IND SOLICITATION
FOLLOW-ON FUNDING
INVESTORS
AARP
Real Possibilities
ANGEL GROUPS
UNUSUAL INVESTORS
Anthem
MOTIVATIONS TO PARTICIPATE WITH TRISH
FREEDOM TO EXPLORE
DE-RISK
MOTIVATIONS TO PARTICIPATE WITH TRISH
NON-DILUTIVE CAPITAL
SCIENTIFIC VET

CURRENT FUNDING OPPORTUNITIES AT TRISH

Cross-sectional approach to touch multiple risks

Building tools to prepare for the UNKNOWNS

BCM.EDU/SPACEHEALTH

Cross-sectional approach to touch multiple risks

Building tools to prepare for the UNKNOWNS

BCM.EDU/SPACEHEALTH

The 2021 Biomedical Research Advances for Space Health (BRASH)

TRISH seeks ways to reversibly manipulate metabolic, homeostatic, or related processes (on a molecular, cellular, tissue, organ or whole organism level) on demand

- Maximize crew health
- Promote resilience to risks and hazards
- Support a more sustainable approach to deep space travel

Translational Research Institute for Space Health (TRISH)

Biomedical Research Advances for Space Health

BRASH 2101

TRANSLATIONAL RESEARCH INSTITUTE FOR SPACE HEALTH

- Annual budget is capped at $500K per year (Direct + Indirect)
- Up to two years
- 10% cost-sharing minimum must be added on top of the maximum budget of $500K per year
- 5-7 proposals anticipated to be awarded

2020 POSTDOCTORAL FELLOWSHIP

SAFEGUARD ASTRONAUT HEALTH AND PERFORMANCE ON THE WAY TO MARS.

The Translational Research Institute for Space Health (TRISH) at Baylor College of Medicine is soliciting proposals from postdoctoral researchers ready to help solve the health challenges of human deep space exploration.

TRISH's postdoc program supports early-career scientists pursuing disruptive, breakthrough research with the potential to reduce risks to astronaut health and performance.

Selected fellows will receive a stipend for salary support, an allowance for health insurance, and funds for travel to related scientific meetings. Applicants must submit research proposals together with an identified mentor and institution.

PROPOSALS DUE JANUARY 28, 2021.

bcm.edu/**spacehealth**

BCM.EDU/SPACEHEALTH

TRISH SCIENCE ALIGNS WITH ON-EARTH APPLICATIONS

- Low “n” = rare diseases
- Personalized medicine
- Tissue and simulated avatars to predict medical risks and recommend safe and effective treatments
- Diversity
- Degenerative scenarios
- Visual impairment
- Behavior
- Self-reliant medial support
- Diagnostic tools
- Countermeasures

Connect with TRISH

SpaceHealth-Info@bcm.edu

trish.force.com

Image from weather.com